

## Claims

What is claimed is:

- 5 1. An optical apparatus for exposing light on a surface area of an object having a curvature, comprising:
  - a mask for providing a pattern of light which undergoes temporal changes to collectively represent an image;
  - 10 a lens positioned to focus the pattern of light on the object; and
  - a motor having a shaft coupled to the object for rotating the object in relation to the temporal changes in the pattern of light to expose the pattern of light
  - 15 over a portion of the surface area of the object.
2. The optical apparatus of claim 1, wherein the object is a spherical object.
- 20 3. The optical apparatus of claim 2, wherein the spherical object is a semiconductor device.
4. The optical apparatus of claim 1, wherein a first exposed portion of the surface area of the object has a
- 25 width and circumscribes the object.
5. The optical apparatus of claim 4, wherein a second exposed portion of the surface area of the object has a width and is non-overlapping with respect to the first
- 30 exposed portion of the surface area of the object.

6. The optical apparatus of claim 1, wherein the mask includes an exposure contour for providing the pattern of light.

5 7. The optical apparatus of claim 6, wherein the exposure contour has a width at a center and becomes wider moving away from the center to an edge of the exposure contour so as to expose the edge of the exposure contour for a longer period of time than the center of  
10 the exposure contour.

8. The optical apparatus of claim 6, wherein the exposure contour has a curvature.

15 9. The optical apparatus of claim 1, wherein the mask includes a mask pattern generator having an active exposure contour for providing the pattern of light.

10. The optical apparatus of claim 9, wherein the mask  
20 pattern generator comprises a digital mirror device.

11. The optical apparatus of claim 9, wherein the mask further includes a mask pattern controller operating in response to control signals and providing a portion of a  
25 mask pattern to the active exposure contour of the mask pattern generator.

12. A method of exposing light on a surface area of an object having a curvature, comprising:  
30 providing a pattern of light through a mask which undergoes temporal changes to collectively represent an image;

directing the pattern of light to the surface area of the object; and

rotating the object in relation to the temporal changes in the pattern of light to expose the pattern of light over a portion of the surface area of the object.

13. The method of claim 12, wherein the object is a spherical semiconductor device.

14. The method of claim 12, further including the step of providing a first exposed portion of the surface area of the object having a width and circumscribing the object.

15. The method of claim 14, further including the step of providing a second exposed portion of the surface area of the object having a width and non-overlapping with respect to the first exposed portion of the surface area of the object.

16. The method of claim 12, wherein the mask includes an exposure contour for providing the pattern of light.

17. The method of claim 16, wherein the exposure contour has a width at a center and becomes wider moving away from the center to an edge of the exposure contour so as to expose the edge of the exposure contour for a longer period of time than the center of the exposure contour.

18. The method of claim 16, wherein the exposure contour has a curvature.

19. The method of claim 12; wherein the mask includes a mask pattern generator having an active exposure contour for providing the pattern of light.
- 5 20. The method of claim 19, wherein the mask pattern generator comprises a digital mirror device.

21. A method of manufacturing a semiconductor device having a curved surface area, comprising:

providing a pattern of light through a mask which undergoes temporal changes to collectively represent an  
5 image;

directing the pattern of light to the curved surface area of the semiconductor device; and

rotating the semiconductor device in relation to the temporal changes in the pattern of light to expose the  
10 pattern of light over a portion of the curved surface area of the semiconductor device.

22. The method of claim 21, wherein the semiconductor device is a spherical semiconductor device.

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23. The method of claim 22, further including the step of providing a first exposed portion of the curved surface area of the semiconductor device having a width and circumscribing the semiconductor device.

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24. The method of claim 23, further including the step of providing a second exposed portion of the curved surface area of the semiconductor device having a width and non-overlapping with respect to the first exposed  
25 portion of the surface area of the semiconductor device.

25. The method of claim 21, wherein the mask includes an exposure contour for providing the pattern of light.

30 26. The method of claim 25, wherein the exposure contour has a width at a center and becomes wider moving away from the center to an edge of the exposure contour so as

to expose the edge of the exposure contour for a longer period of time than the center of the exposure contour.

27. The method of claim 25, wherein a length of the  
5 exposure contour has a curvature.

28. A method of exposing light on a semiconductor device having a curved surface area, comprising:  
generating a pattern of light;  
10 directing the pattern of light to the curved surface area of the semiconductor device; and  
rotating the semiconductor device to expose the pattern of light over a portion of the curved surface area of the semiconductor device.

15 29. The method of claim 28, wherein the semiconductor device is a spherical semiconductor device.

30. The method of claim 28, wherein a first exposed  
20 portion of the curved surface area of the semiconductor device has a width and circumscribes the semiconductor device.

31. The method of claim 30, wherein a second exposed  
25 portion of the curved surface area of the semiconductor device has a width and is non-overlapping with respect to the first exposed portion of the curved surface area of the semiconductor device.

30 32. The method of claim 28, wherein the pattern of light is generated through a mask having an exposure contour.

33. The method of claim 32, wherein the exposure contour has a width at center and becomes wider moving away from the center.

- 5 34. The method of claim 32, wherein the exposure contour has a curvature.